

## CLAIMS

What is claimed is:

- 1    1. A system for accessing multiple different network stations without entry of a password, comprising:
  - 3                a first network station representing a network entity and configured to transmit a request for authentication of a user seeking access, the user having an associated password, an associated user identifier, and an associated asymmetric crypto-key, including a first private key portion obtainable with the password, a second private key portion and a public key portion;
  - 8                a second network station representing the user, and having the user identifier, a combination symmetric crypto-key corresponding to a first symmetric crypto-key and a second symmetric crypto-key, and the obtained first private key portion encrypted with the first symmetric crypto-key stored thereat, and configured to (i) transmit the stored user identifier MAC'd with the stored combination symmetric crypto-key responsive to the transmitted authentication request, and (ii) transmit the transmitted authentication request encrypted with the stored combination symmetric crypto-key; and
  - 16              a third network station, representing a sponsor, having the user identifier, the combination symmetric crypto-key, the first symmetric crypto-key, and the second private key portion stored thereat, and configured to (i) retrieve the stored combination symmetric crypto-key by matching the transmitted user identifier with the stored user identifier, (ii) verify the MAC with the retrieved combination symmetric crypto-key to verify identity of the user, (iii) decrypt the transmitted

22 encrypted authentication request with the retrieved combination symmetric crypto-  
23 key to recover the authentication request, (iv) encrypt the recovered authentication  
24 request with the stored second private key portion and (v) transmit the encrypted  
25 authentication request and the first symmetric crypto-key, both encrypted with the  
26 retrieved combination symmetric crypto-key;

27 wherein the second network station is further configured to (i) decrypt the  
28 transmitted encrypted authentication request and first symmetric crypto-key, with the  
29 stored combination symmetric crypto-key to recover the encrypted authentication  
30 request and the first symmetric crypto-key, (ii) decrypt the stored encrypted first  
31 private key portion with the recovered first symmetric crypto-key to recover the first  
32 private key portion, (iii) to transmit the recovered encrypted authentication request  
33 further encrypted with the recovered first private key portion; and

34 wherein the first station is further configured to decrypt the transmitted further  
35 encrypted authentication request with the public key to thereby authenticate the user.

1 2. A system according to claim 1, wherein the authentication request is a hash  
2 message.

1 3. A system according to claim 1, wherein the second network station is further  
2 configured to receive the password as a user input and obtain the first private key  
3 portion with the input password, prior to transmission of the authorization request by  
4 the first station.

1    4. A system according to claim 1, wherein the combination symmetric crypto-key  
2    corresponds to the first symmetric crypto-key XOR'd with the second symmetric  
3    crypto-key.

1    5. A system according to claim 1, wherein the second network station is further  
2    configured to automatically respond to the authentication request without the user  
3    inputting the password.

1    6. A system according to claim 1, wherein the first symmetric crypto-key is a first  
2    random number having a length of 192 bits and the second symmetric crypto-key is  
3    a second random number, different than the first random number, having a length of  
4    192 bits.

1    7. A system according to claim 1, wherein the third station has a time value,  
2    representing a time period for authenticating the user, stored thereat, and is further  
3    configured to retrieve the stored time value prior to encrypting the recovered  
4    authentication request and to only encrypt the recovered authentication request if the  
5    present time is within the time period represented by the time value.

1    8. A system according to claim 1, wherein the second network station is further  
2    configured to generate the first symmetric crypto-key, and transmit the first  
3    symmetric crypto-key encrypted with the obtained first private key portion to the third  
4    network station;  
5         the third station is further configured to decrypt the transmitted encrypted first  
6    symmetric crypto-key with the second private key portion to recover the first

7 symmetric crypto-key and thereby authenticate the user, to store the decrypted first  
8 symmetric crypto-key, to generate the second symmetric crypto-key, to combine the  
9 first and the second symmetric crypto-key to form the combination symmetric crypto-  
10 key, to store the combination symmetric crypto-key, to transmit the second  
11 symmetric crypto-key encrypted with the first symmetric crypto-key to the second  
12 network station, and to destroy the second symmetric crypto-key; and

13 the second network station is further configured to decrypt the transmitted  
14 encrypted second symmetric crypto-key with the first symmetric crypto-key to  
15 recover the second symmetric crypto-key and thereby authenticate the sponsor, to  
16 combine the recovered second symmetric crypto-key with the first symmetric crypto-  
17 key to form the combination symmetric crypto-key, to store the combination  
18 symmetric crypto-key, to encrypt the first private key portion with the first symmetric  
19 crypto-key, to store the encrypted first private key portion, and to destroy the first  
20 symmetric crypto-key and the unencrypted first private key portion.

1 9. A system for accessing multiple different network stations, comprising:

2 a first station representing a user having a password, an identifier, and an  
3 asymmetric crypto-key, including a first private key portion, a second private key  
4 portion and a public key portion, and configured to transmit a log-in request including  
5 the user identifier; and

6 a second station representing a sponsor and configured to transmit a  
7 challenge responsive to the transmitted log-in request;

8 wherein the first station is further configured (i) to process the user password  
9 to obtain the first private key portion, (ii) to encrypt a first symmetric crypto-key and

10 the transmitted challenge with the obtained first private key portion to form a first  
11 encrypted message, and (iii) to transmit the first encrypted message;

12 wherein the second station is further configured (i) to decrypt the transmitted  
13 first encrypted message with the second private key portion to recover the challenge  
14 and the first symmetric crypto-key, thereby authenticating the user, (ii) to combine  
15 the recovered first symmetric crypto-key with a second symmetric crypto-key to form  
16 a combined symmetric crypto-key, (iii) to store the combined symmetric crypto-key,  
17 (iv) to encrypt the second symmetric crypto-key and a time value with the first  
18 symmetric crypto-key to form a second encrypted message, and (v) to transmit the  
19 second encrypted message;

20 wherein the first station is further configured (i) to decrypt the transmitted  
21 second encrypted message with the first symmetric crypto-key to recover the second  
22 symmetric crypto-key and the time value, thereby authenticating the sponsor, (ii) to  
23 combine the recovered second symmetric crypto-key with the first symmetric crypto-  
24 key to form the combined symmetric crypto-key, (iii) to encrypt the first private key  
25 portion with the first symmetric crypto-key, (iv) to destroy the first symmetric crypto-  
26 key and the obtained first private key portion, (v) to encrypt a request for user  
27 authentication from another network entity with the combined symmetric crypto-key  
28 to form a third encrypted message and (vi) to transmit the user identifier, MAC'd with  
29 the combined symmetric crypto-key, and the third encrypted message;

30 wherein the second station is further configured (i) to match the transmitted  
31 user identifier with the previously transmitted user identifier to retrieve the combined  
32 symmetric crypto-key, (ii) verify the MAC with the retrieved combined symmetric  
33 crypto-key to verify identity of the user, (iii) to decrypt the third encrypted message  
34 with the combined symmetric crypto-key to recover the request for user

35 authentication, (iv) to encrypt the request for user authentication with the second  
36 private key portion to form a fourth encrypted message, (v) to encrypt the first  
37 symmetric crypto-key and the fourth encrypted message with the combined  
38 symmetric crypto-key to form a fifth encrypted message and (vi) to transmit the fifth  
39 encrypted message;

40 wherein the first network station is further configured (i) to decrypt the  
41 transmitted fifth encrypted message with the combined symmetric crypto-key to  
42 recover the transmitted first symmetric crypto-key and the transmitted fourth  
43 encrypted message, and thereby verify an identity of the sponsor, (ii) to decrypt the  
44 encrypted first private key portion with the recovered first symmetric crypto-key, (iii)  
45 to further encrypt the recovered fourth encrypted message with the decrypted first  
46 private key portion to form an authentication message, (iv) to transmit the  
47 authentication message to the other network entity to authenticate the user.

1 10. A method for accessing multiple different network stations without entry of a  
2 password associated with a user also having an associated identifier and an  
3 associated asymmetric crypto-key, including a first private key portion obtainable  
4 with the password, a second private key portion and a public key portion, comprising:

5 receiving a request for authentication of the user;

6 retrieving from a first memory, without entry of the user password, the user  
7 identifier, a combination symmetric crypto-key corresponding to a first symmetric  
8 crypto-key and a second symmetric crypto-key, and the first private key portion  
9 encrypted with the first symmetric crypto-key;

10 encrypting the transmitted authentication request with the retrieved  
11 combination symmetric crypto-key;

12           transmitting the retrieved user identifier MAC'd with the retrieved combination  
13       symmetric crypto-key, and the received authentication request encrypted with the  
14       retrieved combination symmetric crypto-key;

15           matching the transmitted user identifier with a user identifier stored in a  
16       second memory, different than the first memory, to retrieve the combination  
17       symmetric crypto-key from the second memory;

18           verifying the MAC with the retrieved combination symmetric crypto-key to  
19       verify identity of the user;

20           decrypting the transmitted encrypted authentication request with the  
21       combination symmetric crypto-key to recover the authorization request;

22           retrieving the second private key portion and the first symmetric crypto-key  
23       from the second memory;

24           encrypting the recovered authorization request with the retrieved second  
25       private key portion to form an authentication message;

26           transmitting the authentication message and the retrieved first symmetric  
27       crypto-key, both encrypted with the combination symmetric crypto-key;

28           decrypting the transmitted encrypted authentication message and first  
29       symmetric crypto-key, with the combination symmetric crypto-key retrieved from the  
30       first memory to recover the authentication message and the first symmetric crypto-  
31       key;

32           decrypting the retrieved encrypted first private key portion with the recovered  
33       first symmetric crypto-key;

34           encrypting the recovered authentication message with the decrypted first  
35       private key portion to complete the authentication message;

36           transmitting the completed authentication message; and

36            decrypting the transmitted completed authentication message with the user  
37        public key to thereby authenticate the user.

1        11. A method according to claim 10, wherein the authentication request is a hash  
2        message.

1        12. A method according to claim 10, further comprising:  
2            processing the user password to obtain the first private key portion, prior to  
3        receipt of the authentication request.

1        13. A method according to claim 10, further comprising:  
2            XOR'ing the first symmetric crypto-key with the second symmetric crypto-key  
3        to generate the combination symmetric crypto-key.

1        14. A method according to claim 10, wherein the first symmetric crypto-key is a first  
2        random number having a length of 192 bits and the second symmetric crypto-key is  
3        a second random number, different than the first random number, having a length of  
4        192 bits.

5  
5        15. A method according to claim 10, further comprising:  
6            retrieving a time value, representing a time period for authenticating the user,  
7        from the second memory; and  
8            only encrypting the recovered authentication request if the present time is  
9        within the time period represented by the retrieved time value.

1        16. A method according to claim 10, further comprising:  
2            generating the first symmetric crypto-key;  
3            transmitting the first symmetric crypto-key encrypted with the obtained first  
4        private key portion;  
5            decrypting the transmitted encrypted first symmetric crypto-key with the  
6        second private key portion to recover the first symmetric crypto-key and thereby  
7        authenticate the user;  
8            storing the decrypted first symmetric crypto-key in the second memory;  
9            generating the second symmetric crypto-key;  
10          combining the first and the second symmetric crypto-keys to form the  
11        combination symmetric crypto-key;  
12          storing the combination symmetric crypto-key in the second memory;  
13          transmitting the second symmetric crypto-key encrypted with the first  
14        symmetric crypto-key;  
15          destroying the second symmetric crypto-key;  
16          decrypting the transmitted encrypted second symmetric crypto-key with the  
17        first symmetric crypto-key to recover the second symmetric crypto-key and thereby  
18        authenticate the sponsor;  
19          combining the recovered second symmetric crypto-key with the first  
20        symmetric crypto-key to form the combination symmetric crypto-key;  
21          storing the combination symmetric crypto-key in the first memory;  
22          encrypting the first private key portion with the first symmetric crypto-key;  
23          storing the encrypted first private key portion in the first memory; and  
24          destroying the first symmetric crypto-key used to encrypt the first private key  
25        portion and the unencrypted first private key portion.

1        17. A method for accessing multiple different network stations by a user having a  
2        user identifier, a user password and an asymmetric crypto-key, including a first  
3        private key portion, a second private key portion and a public key portion;  
4                transmitting a log-in request including the user identifier;  
5                transmitting a challenge of a sponsor responsive to the transmitted log-in  
6        request;  
7                processing the user password to obtain the first private key portion;  
8                encrypting a first symmetric crypto-key and the transmitted challenge with the  
9        obtained first private key portion to form a first encrypted message;  
10          transmitting the first encrypted message;  
11          decrypting the transmitted first encrypted message with the second private  
12        key portion to recover the challenge and the first symmetric crypto-key, and thereby  
13        authenticate the user to the sponsor;  
14          combining the recovered first symmetric crypto-key with a second symmetric  
15        crypto-key to form a combined symmetric crypto-key;  
16          storing the combined symmetric crypto-key in a first memory;  
17          encrypting the second symmetric crypto-key with the first symmetric crypto-  
18        key to form a second encrypted message;  
19          transmitting the second encrypted message;  
20          decrypting the transmitted second encrypted message with the first symmetric  
21        crypto-key to recover the second symmetric crypto-key, and thereby authenticate the  
22        sponsor to the user;  
23          combining the recovered second symmetric crypto-key with the first  
24        symmetric crypto-key to form the combined symmetric crypto-key;

25           storing the combined symmetric crypto-key in a second memory, different  
26       than the first memory;

27           encrypting the first private key portion with the first symmetric crypto-key;

28           destroying the first symmetric crypto-key used to encrypt the first private key  
29       portion and the obtained first private key portion;

30           encrypting a request for authentication of the user with the combined  
31       symmetric crypto-key to form a third encrypted message;

32           transmitting the user identifier, MAC'd with the combined symmetric crypto-  
33       key, and the third encrypted message;

34           matching the transmitted user identifier with the previously transmitted user  
35       identifier to retrieve the combined symmetric crypto-key from the second memory;

36           verifying the transmitted MAC with the retrieved combined symmetric crypto-  
37       key to verify an identity of the user;

38           decrypting the third encrypted message with the combined symmetric crypto-  
39       key to recover the request for user authentication;

40           encrypting the request for user authentication with the second private key  
41       portion to form a fourth encrypted message;

42           encrypting the first symmetric crypto-key and the fourth encrypted message  
43       with the combined symmetric crypto-key stored in the first memory to form a fifth  
44       encrypted message;

45           transmitting the fifth encrypted message;

46           decrypting the transmitted fifth encrypted message with the combined  
47       symmetric crypto-key stored in the second memory to recover the transmitted first  
48       symmetric crypto-key and the transmitted fourth encrypted message, and thereby  
49       verify an identity of the sponsor;

50           decrypting the encrypted first private key portion with the recovered first  
51       symmetric crypto-key;  
52           further encrypting the recovered fourth encrypted message with the decrypted  
53       first private key portion to form an authentication message;  
54           transmitting the authentication message to the other network entity to  
55       authenticate the user.

1           18. A method for accessing multiple different network stations without entry of  
2       a password associated with a user having an associated first symmetric crypto-key,  
3       an associated second symmetric crypto-key and an associated asymmetric crypto-  
4       key, including a first private key portion, a second private key portion and a public  
5       key portion, comprising:  
6           encrypting the first private key portion with the first symmetric crypto-key;  
7           transmitting a request, of a network station, for authentication of the user,  
8       encrypted with the second symmetric crypto-key to a sponsor;  
9           decrypting the transmitted encrypted authentication request with the second  
10       symmetric crypto-key to recover the authentication request;  
11           encrypting the recovered authentication request with the second private key  
12       portion to form an authentication message;  
13           transmitting the authentication message and the first symmetric crypto-key,  
14       both encrypted with the second symmetric crypto-key to the user;  
15           decrypting both the transmitted encrypted authentication message and the  
16       transmitted encrypted first symmetric crypto-key with the second symmetric crypto-  
17       key to recover the authentication message and the first symmetric crypto-key;

18        decrypting the first private key portion with the recovered first symmetric  
19        crypto-key;  
20        transmitting the authentication message encrypted the recovered first  
21        symmetric crypto-key to the network station; and  
22        decrypting the transmitted encrypted authentication message with the public  
23        key portion to recover the authentication request and thereby authenticate the user  
24        to the network station.